

## SECTION IV-4 - MECHANICAL DESIGN CRITERIA

### 4.1 Pumps

#### A. General

All stations shall have a minimum of two pumps of equal capacity. The pumps shall be solids handling, submersible type centrifugal pumps capable of meeting the design flow. The pump manufacturer shall be responsible for supplying the pump, motor, discharge elbow, anchor bolts, guide rails, and all miscellaneous stainless steel hardware required to place the submersible pump within the wetwell.

#### B. Design Considerations

Upon selection of the number and type of pumps, the engineer shall plot the system curves versus the pump curve. One system curve shall be developed using a C factor of 120, and another system curve shall be developed using a C factor of 140. The selected pumps should be able to pump at a minimum efficiency of 60% between the heads generated between these C factors. In addition, the engineer shall verify that the NPSH available is always at least 5' greater than the NPSH required.

#### C. Pump and Motor Requirements

1. Allowable pump manufacturers shall be pre-approved by Water Department
2. Pumps shall be non-clog submersible, or approved equal, capable of passing a minimum 3" diameter solid.
3. Motors shall be non-overloading over the entire range of pump operation.
4. Submersible pumps shall be removable for inspection or service without entering the wetwell.

#### D. Valve Vault Sump Pump

The slope of the valve vault floor shall drain all water to a float activated sump pump. The sump pump will pump water directly into the wetwell. In general, the sump pump will be located in a 24" deep by 24" diameter sump. Sump pumps shall be provided with a check valve and shutoff valve, located in the valve vault.

### 4.2 Piping

A. General

Each pump shall have an individual discharge pipe complete with flanged coupling adaptor, check valve, and shut off valve. Piping shall be sized so that the maximum discharge velocity does not exceed eight feet per second.

B. Emergency Bypass Allowance

The lift station piping shall allow an emergency bypass of the lift station wetwell. In general, this involves placing a tee with a valve and quick connect on the discharge side of the shutoff valves.

C. Flexible Connections

A flexible connection, consisting of a flange coupling adaptor, shall be installed on each pump's discharge piping between the valve vault wall and the check valve in order to allow for removal and maintenance of valves and fittings.

E. Exposed Piping

All exposed piping shall be flanged ductile iron. Exposed piping shall be painted with a primer and coating combination acceptable to the Water Department. Flanged pipe and fittings within the wetwell and valve vault shall be supported in order to avoid excessive stress to flanges and to allow for routine maintenance.

4.3 Valves

A. Surge and Pressure Relief Valves

Surge or pressure relief valves shall be required where the surge pressure exceeds the pressure rating of the pipe. The surge relief line shall be piped back into the wetwell. Surge and pressure relief valves shall be of a type and manufacturer acceptable to the Water Department.

B. Check Valves

Each pump shall have a dedicated check valve placed on the discharge side of the pump, located within the valve vault. Check valves shall not be installed vertically.

For pumping systems where the velocity through the check valve is under 5 fps and the system head is less than 60', check valves may be swing type with weighted lever. For pumping systems where the system head is greater than 60', check valves shall be cushioned check valves. Check valves shall be of a type and manufacturer acceptable to the Water Department.

C. Shutoff Valves

Each pump shall have a dedicated shutoff valve, preferably a resilient seated gate valve or plug valve, placed downstream of the check valve, located in the valve vault. Shutoff valves shall be of a type and manufacturer acceptable to the Water Department.

D. Air and Vacuum Valves

Combination air and vacuum valves shall be placed as required to vent air accumulation in the force main and to prevent negative pressures from occurring within the force main. Combination air and vacuum valves shall be required at all peak/high points and all valleys/low points along the force main vertical profile. Combination air and vacuum valves shall be of a type and manufacturer acceptable to the Water Department.

4.4 Access Hatches

A. Type

Access hatches shall be aluminum frame with stainless steel hardware. Hatches shall be lockable with recessed hasp. When access hatches are placed below the 100 year base flood elevation, the access hatches must be flood proof. Provide hatch nets or other approved fall prevention system for hatches which provide access into the wetwell. Acceptable manufacturer's include Bilco, Flygt, or approved alternate.

B. Load Rating

Unless otherwise specified, access hatches shall be designed for 300 pounds per square foot load rating.

4.5 Ladders and Ladder Safety Equipment (Valve Vault Only)

A. Aluminum Ladder

The minimum allowable ladder width shall be 16". Rung spacing shall be 12", center to center. Top rung shall be placed no more than 12" from the top hatch elevation. Bottom rungs shall be placed a maximum of 12" from valve vault finished floor.

B. Ladder-Up Safety Device

A ladder safety extension, shall be provided with the ladder. Ladder extension shall be easily reachable from the top slab of the valve vault.

#### **4.6 Interior Hardware**

Hardware used within the wetwell, to include pipe supports, pump guide rails, pump lifting chains, pipe fasteners, anchor bolts, clasps, etc., shall be stainless steel.

#### **4.7 Pipe Penetrations**

All penetrations into the lift station wetwell shall be water-proof. As the Fort Worth Water Department recommends that both the valve vault and the wetwell be constructed using cast in place reinforced concrete, it is recommended that pipe penetrations use manufactured wall pipe or other approved method.

Where electrical conduit must pass through concrete walls, use wall sleeves or core through walls and provide waterproof and gas proof seals using link seals, or other approved method.

#### **4.8 Pressure Gauges**

Each pump discharge shall be fitted with a minimum 2" glycerin filled pressure gauge with shutoff valve. The gauge range shall be as required to gage the pump discharge head over the entire range of operation.